Harnessing Nature's Power

Spain is a World Leader in Wind Energy

by John Whitman

Spain is a world leader in the generation of power from renewable resources, especially from wind and water. The country is the third largest producer of wind power in the world and an important producer of hydroelectric energy, according to ***IbeRenova***, a division of ***Iberdrola, S.A.***

Spain is well-positioned for the European Union's (E.U.) requirement that by 2010, 12% of the continent's primary energy demand be supplied through renewable sources. This figure doubles 1997 levels.

The Spanish government has committed to meeting the E.U.'s target, passing into law the Electricity Sector Act of 1997. This law regulated prices for electricity generated from renewable sources and provided technical guidelines for its adoption and use.

Forty-one percent of the power generated by Iberdrola for Spanish domestic consumption is derived from renewable resources. Hydroelectric power makes up the bulk of this total.

Iberdrola is the second-largest electric power producer in Spain. IbeRenova is the division of Iberdrola dedicated to researching, developing and bringing to market electrical energy derived from renewable resources.

The company views renewable resources as attractive due to their increasing commercial viability and their low environmental impact.

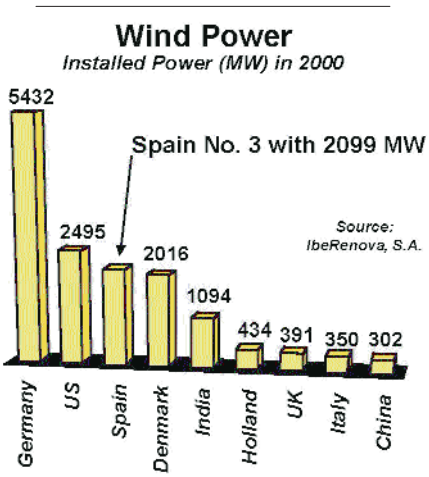
For example, a single windmill with a 1.65-MW wind turbine is capable of displacing 2,700 tons of carbon dioxide, 14 tons of sulfur dioxide, and nine tons of nitrogen oxides, according to the ***American Wind Energy Association (A.W.E.A.)***, a national trade association for the United States wind energy industry. These figures are based on the average fuel mix in the United States. To absorb this amount of carbon dioxide, a forest measuring 1.5 square miles would be required.

A.W.E.A. also reports that the cost of producing electricity from wind energy in the United States has declined by more than 80%, from about 38 cents/kWh in the early 1980s to a current range of 3-6 cents/kWh. Some analysts see prices continuing to fall to 2.5 cents/kWh.

Renewable resources also help Spain reduce its dependence on foreign energy sources, while driving regional economic growth and employment creation.

Wind energy

Spain is the third-largest producer of wind power in the world, behind Germany and the United States.



In 1999 Spain was ranked fourth. However, after installing more than 500 MW of power in 2000 – a 36% gain – Spain vaulted to third. If these growth rates continue, Spain may soon surpass the United States in terms of installed power.

Today Germany is the undisputed leader. As of September 2000, the country controlled 5,432 MW of installed power.

In the late 1990s, Germany underwent a period of accelerated growth. Energy providers doubled capacity in 1999, installing more than 1,000 MW. Power grew by another 23% in 2000.

Strong gains should continue. The ***German Institute for Wind Power (D.E.W.I.)*** projects 20% annual increases in installed power through 2003.

A.W.E.A. estimates that the world today has at its disposal approximately 150,000 MW of wind capacity, sufficient to generate 30 billion kilowatt-hours of electricity each year.

This amount of energy would supply electricity to four million average New York households – meeting the energy needs of 11 million people.

Within Spain, more than 150 projects for windmill farms in six autonomous communities either are under consideration or are actively being planned. Current projects call for the construction of an additional 1,500 MW of power.

The Spanish provinces that produce the most wind power are Galicia and Navarra. These two communities alone make up 67% of Spain's total.

In Galicia, ambitious plans are under way to build an additional 41 windmill farms by 2005, raising the province's total to 56. As a result, authorities expect wind-derived power to post a 10-fold gain over the next five years, soaring to 3,000 MW from today's 257 MW.

By 2015, IbeRenova expects windmill farms in Spain to generate as much electricity as hydroelectric sources. Iberdrola plans to invest 1.4 billion euros in wind power by 2010 and plans to install 3200 MW by 2005.

Some experts estimate that Europe could see generating capacity in excess of 100,000 MW installed by 2030, assuming political support exists for such an objective.

Countries such as France and Germany hold the potential for high growth, since they have completed a limited number of wind projects, but have at their disposal abundant resources.

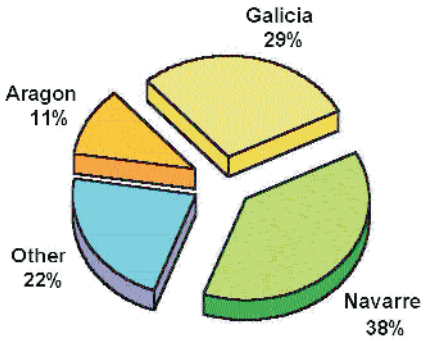
However countries with high windmill densities might turn to the seas, building windmill farms offshore.

This is the case of Denmark. At 46.8 MW per 1000 km^2, this Scandinavian country has the highest windmill density in the world. This figure is three times Germany's 15 MW per 1000 km^2.

For this reason, experts make only moderate projections for wind power growth in Denmark. Offshore projects may allow continued expansion.

In Spain, a proposal for the first offshore wind power project was announced in February. ***Energía Hidroeléctrica de Navarra***, a regional power company in Spain, plans to construct a 2,500-hectare windmill farm in the waters off of Cadiz.

Spain's Wind Energy
Production by Province in 1999



Source: IbeRenova, S.A.

The network of five windmill farms would be connected by two underwater cables to a substation to be constructed in El Palmar. During the pilot stage, 10 windmills would be installed with a total of 20 MW of generating capacity. During the second stage, 90 more turbines would be installed for an additional 180 MW.

For windmills manufactured within the E.U., power output currently varies from 10 W to 1.5 MW. Windmills with a generating capacity between one and three megawatts are either under development or under construction.

By comparison, a mid-sized hydroelectric dam typically produces from 10 to 50 MW of power. A windmill farm would have to be stocked with 50 windmills with a capacity of one megawatt each in order to generate the same amount of energy.

International Developments

Beyond Spain's borders, IbeRenova has renewable energy projects under development throughout the world:

***Central America and Brazil*:** The company is participating in the analysis, management and development of projects drawing on hydropower, wind, and other renewable energy sources. The company is also surveying and selecting local partners with the goal of identifying new business opportunities.

Portugal*:** IbeRenova, together with Enernova, a subsidiary of the Portuguese energy company ***EDP, has successfully passed the prequalification stage for a number of wind and hydroelectric projects.

Morocco: Together with EDP International, ***Enernova*** and ***Enercon***, the company is bidding on a project to construct a 200 MW windmill farm.

In order to reduce its dependence on foreign sources of energy, Morocco is moving forward with efforts to build windmill farms. Half of all Moroccans live in rural areas. Electricity only reaches 10% of these homes.

The first farm in El Beida will take advantage of the strong winds along the Atlantic coast. The farm will consist of 84 windmills and 50MW of power. The firm ***Germa, Paribas and Vestas*** is responsible for construction of the project.

The next round of windmill farms, worth an estimated 26.9 billion pesetas, are being bid on by nine international groups. Among those is the consortium formed by IbeRenova, EDP and Enercon. The project calls for the construction of windmills generating 200 MW of power, and will be located in Tangiers and Tarfaya. These two parks will generate 2% of Morocco's energy needs.

IbeRenova's goal is to lead the renewable energy market and participate in hydroelectric plants, windmill farms and projects that harness biomass and solar power in order to contribute to the European Union's goal of satisfying 12% of internal demand for primary energy through renewable sources. IbeRenova has the financial backing and technical support of its parent company, Iberdrola Group.